

Beach Replenishment

Background

Beach replenishment is the addition of sand to beaches, usually to restore their contours by replacing sand that has washed away. Over the long-term, quantities of sand added to beaches can be used as an approximate surrogate for quantities of sand lost from beaches due to erosion.

New Jersey's beaches are a vital recreational resource as well as a buffer between ocean waves and landward development. The State has an interest in maintaining its beaches for public recreational use and shore protection. Interest in shore protection in New Jersey began in the mid-1800s. The state's shorelines, being within easy reach of the burgeoning populations of New York City and Philadelphia, were the first to experience intense barrier-island development. Oceanfront dunes were leveled and freshwater ponds between dunes were filled to create building lots. Rapid development ensued without awareness of coastal hazards, storm vulnerability, or beach erosion. A period of intense storm and hurricane activity between 1915 and 1921, in which three hurricanes and four tropical storms passed within several nautical miles of the coasts of New Jersey and New York, highlighted the sensitivity of newly-developed shore regions to beach erosion. Soon thereafter, the first protective works ("groins") were built to slow the erosion process. Millions of dollars were spent on uncoordinated and often inappropriate erosion-control structures that frequently produced results that were ineffective, and in some cases, counterproductive.¹ Piecemeal approaches often aggravated the problem on adjacent shorelines. The state began approaching shore protection on a regional basis within areas affected by similar coastal processes with the development of the Shore Protection Master Plan in 1981.² This approach considers the potential for any one shore erosion control program to adversely affect another.

A number of programs within DEP are charged with managing coastal resources, minimizing impacts from development on these resources, such as surf clam and shorebird habitats, and minimizing development in hazard areas, including newly replenished beaches. Together, these

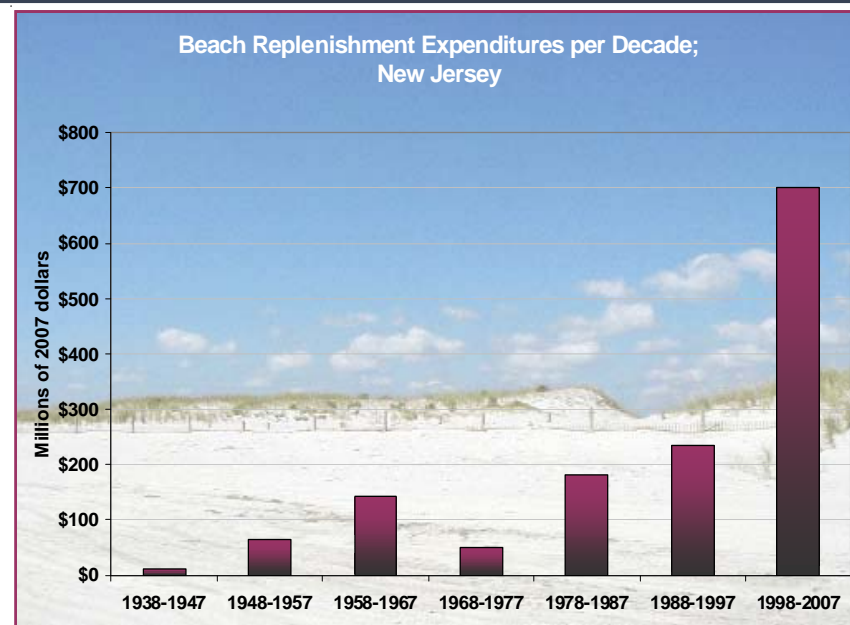
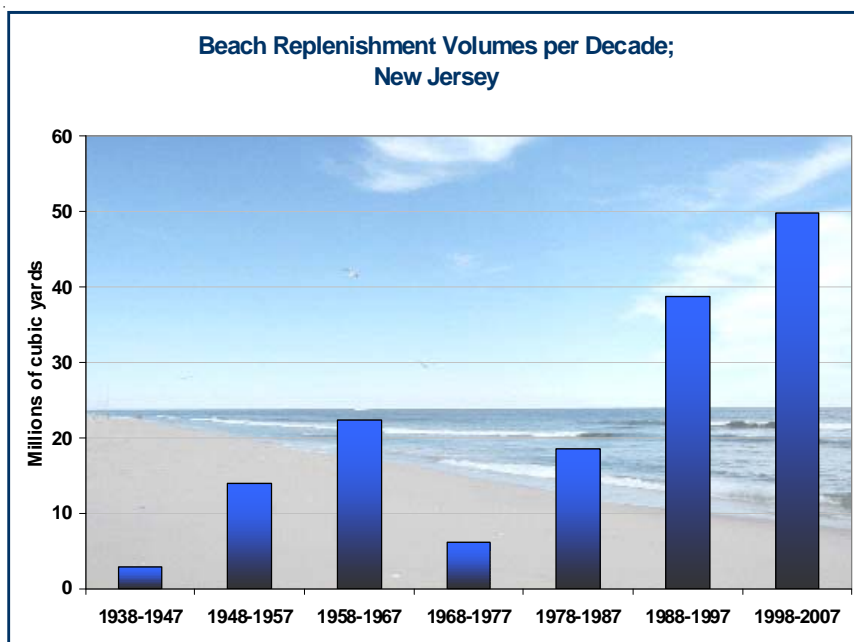
programs comprise DEP's Coastal Management Program.³ The Coastal Management Program is comprised of a network of offices within the New Jersey Department of Environmental Protection that serve distinct functions yet share responsibilities that influence the state of New Jersey's coast. A central component of New Jersey's Coastal Management Program is the Coastal Management Office, which is part of the Commissioner's Office of Policy, Planning and Science. The Coastal Management Office administers the planning and enhancement aspects of New Jersey's federally approved Coastal Management Program. The Division of Land Use Regulation, one arm of the Coastal Management Program, implements these protections through a number of different permitting programs, including the Coastal Area Facility Review Act (CAFRA) and Waterfront Development Law. In addition, the Bureau of Coastal Engineering in the Natural and Historic Resources' Office of Engineering and Construction is responsible for overseeing beach nourishment, shore protection and storm damage reduction, and coastal dredging projects.

New Jersey's beaches play a critical role in protecting people and property from coastal storm hazards. Due to its geography, New Jersey is sometimes in the path of hurricanes (tropical storms) and nor'easters (extratropical storms). Beaches act as a buffer between the surf and the homes, businesses and infrastructure along the coast. In addition, beaches provide recreation for beachgoers and fishermen and help support a multibillion dollar tourism industry. In 2008, the total economic impact of travel and tourism was \$27.9 billion to the state, which accounted for 5.8 percent of the gross state product. In addition, 72 percent of each tourism dollar spent in New Jersey was retained in state, and 10.9 percent of the total employment in the state, 443,094 jobs, was due to travel and tourism economic activity. In 2008, tourism generated \$7.7 billion in federal, state, and local government taxes. A regional breakdown of tourism shows that 33.4 percent of total statewide tourism expenditure occurs in Atlantic County, with the Southern Shore Region (Cape May and Cumberland counties) and the Shore Region (Monmouth and Ocean counties), contributing 14.5 percent and 13.9 percent respectively. In addition, Atlantic, Cape May, and Ocean counties are leaders in terms of tourism expenditure by county; these three counties combined contribute over half of New Jersey's total tourism expenditure.⁴

Attention to shoreline management is becoming more important as the sea level along the New Jersey coast rises due primarily to climate change (see Climate Change in New Jersey: Trends in Temperature and Sea Level, in this Environmental Trends series). Rising seas are likely to accelerate beach erosion and coastal inundation, and will make storms and associated floods more intense, exacerbating erosion. Examination of shoreline positions along the Atlantic Ocean in New Jersey from 1836 to 1986 reveals the trend of shoreline erosion.⁵ Historically, New Jersey built sea walls, groins and jetties as a defense against beach erosion. Today, in most cases, beach nourishment is preferred to hard structures such as seawalls and bulkheads, because it has less adverse impact. Beach nourishment provides the basis for restoration of landforms and biota, and for recovery of lost environmental heritage. Dune construction is an integral component of beach nourishment, important to restoring natural beach functioning and habitat value.⁶

Status and Trends:

Replenishment of beaches with sand pumped or dredged from bay areas and from the ocean floor began in the 1930s, and the quantities of sand placed on beaches, and the associated costs, have been cataloged since then.⁷ Values for gaps in these data have been estimated by the DEP,⁸ and the data are shown in the two charts, "Beach Replenishment Volumes per Decade; New Jersey" and "Beach Replenishment Expenditures per Decade, New Jersey."



Outlook and Implications

The data shown in these charts indicate a trend of both increasing quantities of sand deposited per decade, and increasing constant-dollar costs per decade for the replenishment efforts. Continuation of such increasing trends will inevitably collide with resource and financial constraints.

However, alternative approaches to protecting the shore are not apparent.⁹ Structural shore protection measures, such as groins and jetties to retard the longshore transport of sand by littoral drift, and seawalls, bulkheads and revetments to prevent waves from reaching erodible materials have proven to be inadequate and incomplete solutions. Given the densely developed nature of the New Jersey oceanfront, opportunities for setbacks and other land use regulation actions are limited. Non-structural measures such as beach nourishment recognize the natural processes along the shoreline, and are therefore the preferred method for maintaining recreational beaches and providing storm damage reduction.¹⁰

The cost of protecting threatened property and undeveloped coastlines from sea-level rise in the mid-Atlantic through 2100 is estimated to be in excess of \$20 billion.¹¹ Until 2009, approximately 65 percent of the funding for beach replenishment projects has been federal. In 2009, in the absence of sufficient federal funding and facing the immediate need for beach replenishment, DEP constructed beaches and dunes in a four municipality project with cost of \$19 million to the state and \$6 million to the municipalities. There is concern that less federal money will be available in the future for beach replenishment projects, just when need for the projects is increasing.

It is likely that rising sea level, coupled with the increased intensity of storms predicted by models of climate change, will result in flooding and beach erosion that will worsen over time. A steady increase in beach replenishment would be needed in order to maintain usable beaches and provide shore protection. Increased preparedness for floods and coastal damages also will be required.



More Information

www.nj.gov/dep/shoreprotection/
www.nj.gov/dep/cmp/czm_program.html
www.nap.usace.army.mil/index.htm
www.state.nj.us/commerce/Tourism.shtml

References

- ¹ National Shoreline Study; <http://www.iwr.usace.army.mil/NSMS/National%20Shoreline%20Study.pdf>
- ² NJ Department of Environmental Protection (NJDEP), 1981, New Jersey Shore Protection Plan, Volumes I and II, NJDEP, Trenton, NJ
- ³ http://www.state.nj.us/dep/cmp/czm_program.html
- ⁴ McGill, Kenneth, 2009, NJ Tourism: Holding Its Own During Difficult Times, <http://www.visitnj.org/sites/visitnj.org/files/tourism-ecom-impact-2008.pdf>
- ⁵ Farrell, S., Inglin, D., Vanazi, P., and Leatherman, S., 1985, *A Summary Document for the Use and Interpretation of the Historical Shoreline Change Maps for the State of New Jersey*, Stockton State College Coastal Research Center, 24 pp.
- ⁶ Nordstrom, Karl F. and Mark N. Mauriello, 2001, "Restoring and Maintaining Naturally-Functioning Landforms and Biota on Intensively Developed Barrier Islands Under a No-Retreat Alternative," *Shore & Beach* 69, No. 3, 19-28.
- ⁷ Coburn, Andrew, 2009; Program for the Study of Developed Shorelines, Western Carolina University; personal communication A. Coburn, acoburn@email.wcu.edu, with M. Aucott, NJDEP, December, 2009.
- ⁸ Aucott, Michael., 2009, New Jersey DEP, Office of Science
- ⁹ A technology using what are called pressure equalizing modules is reported to have proven effective in Europe and is being used in Hillsborough Beach, Florida. See <http://www.ecoshore.com>
- ¹⁰ Mauriello, Mark N., 1991, Beach Nourishment and Dredging: New Jersey's Policies, *Shore & Beach* 59, No. 3, July 1991, pp. 25-28.
- ¹¹ Titus, James, et al., 1991, Greenhouse Effect and Sea Level Rise: The Cost of Holding Back the Sea," *Coastal Management* 19, 171-204.